



Carbon Based Environmental Pty Limited

ABN 74 102 920 285

Rocla Quarry Products Calga Quarry

Environmental Monitoring

Dust Deposition Gauges, Surface and Ground Waters and Meteorological Station

December 2013

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Environmental Scientist
Date: 31 January 2013

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Executive Summary

Carbon Based Environmental is contracted by Rocla Quarry Products to conduct environmental monitoring at the Calga Sand Quarry.

The monitoring includes;

- Dust Deposition Gauges;
- Surface Waters;
- Groundwaters; and
- Meteorological Station.

This report was prepared by Carbon Based Environmental and includes the following;

- Dust Deposition results for December 2013;
- Surface Water quality results for December 2013;
- Groundwater depth and quality results for December 2013; and
- Meteorological report for December 2013.

The December 2013 dust deposition results for insoluble solids were generally low and free of major contamination this month with the exception of CD1 which was deemed excessively contaminated. All sites, on a rolling annual average basis, are currently below the Air Quality Management Plan exceedance level of 3.7g/m².month. Results were found to be representative of dust levels as determined by the Australian Standard.

Surface water samples were collected on 3 January 2014 at sites A and F. Site C was inaccessible and unable to be sampled this month. There was no flow at Site B and Site D was dry at the time of sampling this month. The samples were collected and analysed for a monthly sampling event. Results show pH within the acidic range, low Electrical Conductivity, low Total Dissolved Solids and low Total Suspended Solids. Oil and Grease was not detected at any site.

Groundwaters were sampled for normal monthly monitoring on 3 January 2014. Groundwater depth generally increased across the sampled groundwater bores when compared to last month with the exceptions being CP3 and MW8 which decreased in depth. Groundwater pH and EC were generally stable this month.

The meteorological station data recovery for the month was approximately 100%. Recorded rainfall on site for December was 14.4 mm, which was lower than the Peats Ridge long-term average for December. A comparison is shown below:

Rocla Calga Quarry	14.4 mm
BOM Peats Ridge*	NA
BOM Gosford*	17.8 mm
BOM Peats Ridge Long term mean for December*	95.2 mm

NA = Not Available

*Data sourced from Bureau of Meteorology (BOM) website (www.bom.gov.au). No data was available from the BOM Peats Ridge station for December 2013

Note: Differences in the daily rainfall readings between BOM and the Rocla station may occur due to BOM stations reporting rainfall at 9am and the Rocla station recording rainfall at midnight.

Sampling Program

Rocla Calga Quarry conducts environmental monitoring in accordance to Development Consent, OEH (EPA) licence and Environmental Management Plans. Carbon Based Environmental are contracted to undertake dust deposition gauge, surface and groundwater and meteorological monitoring for the project. Carbon Based Environmental commenced monitoring from the April 2006 monitoring period.

Dust deposition gauges are operated to the Australian Standard AS3580.10.1 “Methods for Sampling and Analysis of Ambient Air Method 10.1 Determination of Particulates—Deposited Matter—Gravimetric Method”. Sampling is undertaken every 30 +/- 2 days and each gauge is analysed for insoluble solids and ash residue. The results are reported as g/m².month.

Surface waters are sampled in accordance with Australian Standards AS5667.1 “Guidance on the Design of Sample Programs, Sampling Techniques and the Preservation and Handling of Samples”, AS5667.6 “Water Quality Sampling—Guidance on sampling of rivers and streams” and AS5667.4 “Water Quality Sampling—Guidance on sampling from lakes, natural and man-made”. Surface water monitoring sites include local streams and dams. Basic analysis including pH, Electrical Conductivity, Total Suspended Solids, Total Dissolved Solids and Total Oil and Grease is conducted monthly at Sites A and F (dams) and when Sites B, C and D are flowing. Additional samples are collected when daily rainfall exceeds 50mm.

Groundwaters are sampled in accordance with Australian Standards AS5667.1 “Guidance on the Design of Sample Programs, Sampling Techniques and the Preservation and Handling of Samples” and AS5667.11 “Water Quality Sampling—Guidance on sampling of ground waters”. Groundwater monitoring sites are sampled at least bi-monthly for water quality and at least quarterly for water level. Groundwater monitoring loggers continuously record water levels in a selection of bores.

Meteorological monitoring is conducted at the quarry and displayed on the site computer with a real time display. Wind parameters are measured according to Australian Standard AS 2923 “Ambient Air— Guide for Measurement of Horizontal Wind for Air Quality Applications”.

The weather stations have the following sensor configuration;

Air temperature

- Humidity
- Rainfall
- Atmospheric pressure
- Evaporation
- Solar radiation
- Wind speed
- Wind direction

Carbon Based Environmental continued to operate the monitoring equipment and utilise site collections at their existing locations.

The locations of monitoring points are provided in **Figure 1**.

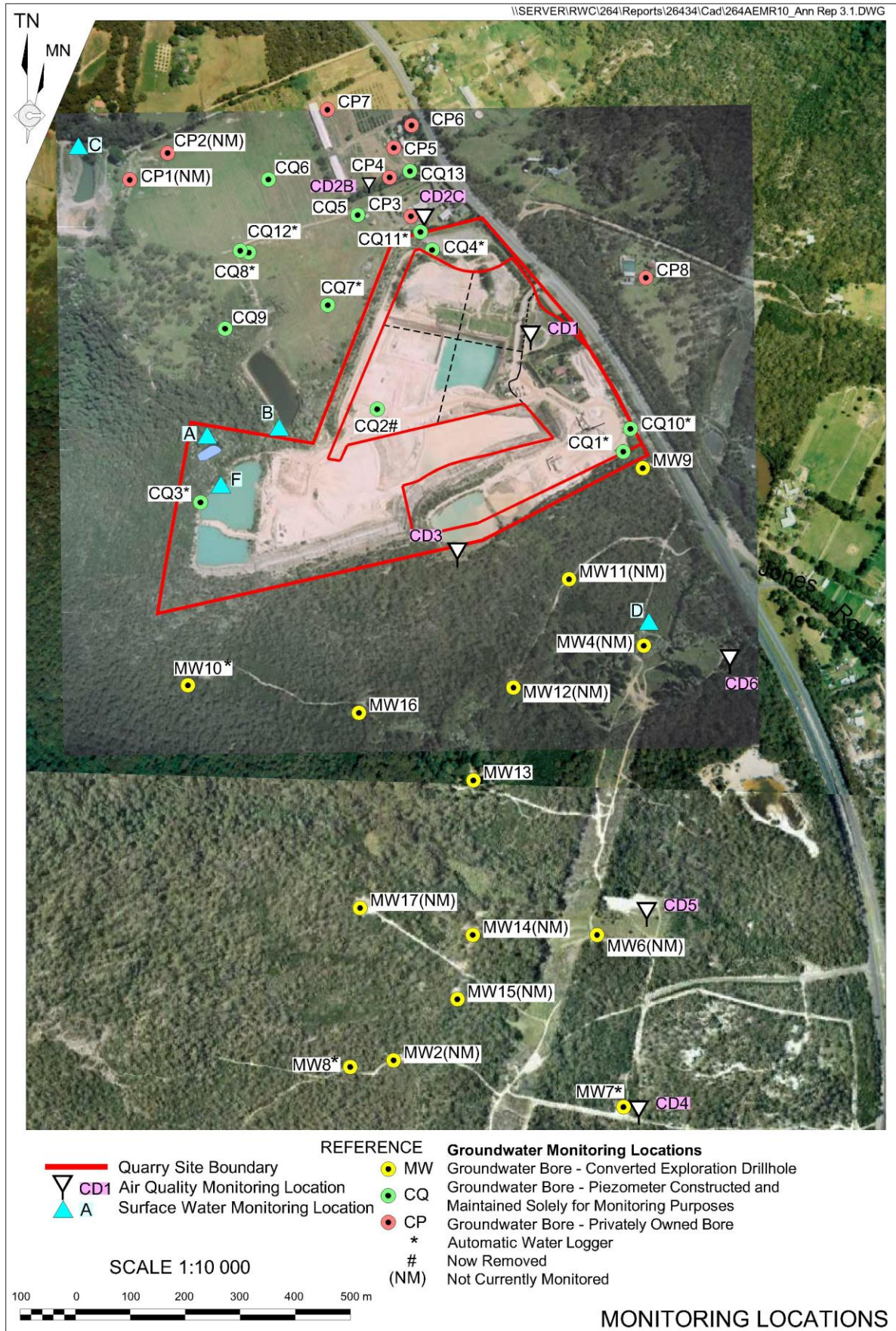


Figure 1: Rocla Calga Quarry environmental monitoring locations

2.0 Monthly Results

2.1 Dust Deposition Gauges

Table 1 displays the results for December 2013 and the project 12 month rolling average. Results are in g/m².month.

Table 1: Dust Deposition results: 3 December 2013 – 3 January 2013 (31 days)

Site	Monthly Insoluble Solids g/m ² .month	Monthly Ash Residue g/m ² .month	Monthly Combustible Matter g/m ² .month	Monthly Ash Residue/ Insoluble Solids %	Rolling Annual Average Insoluble Solids g/m ² .month
CD1	3.8*	2.2	1.6	58	1.4
CD2c	1.4	1.0	0.4	71	1.1
CD3	2.0	1.6	0.4	80	2.2
CD4	1.1	0.5	0.6	45	0.5
CD5	0.9	0.4	0.5	44	0.4
CD6	1.2	0.7	0.5	58	0.6

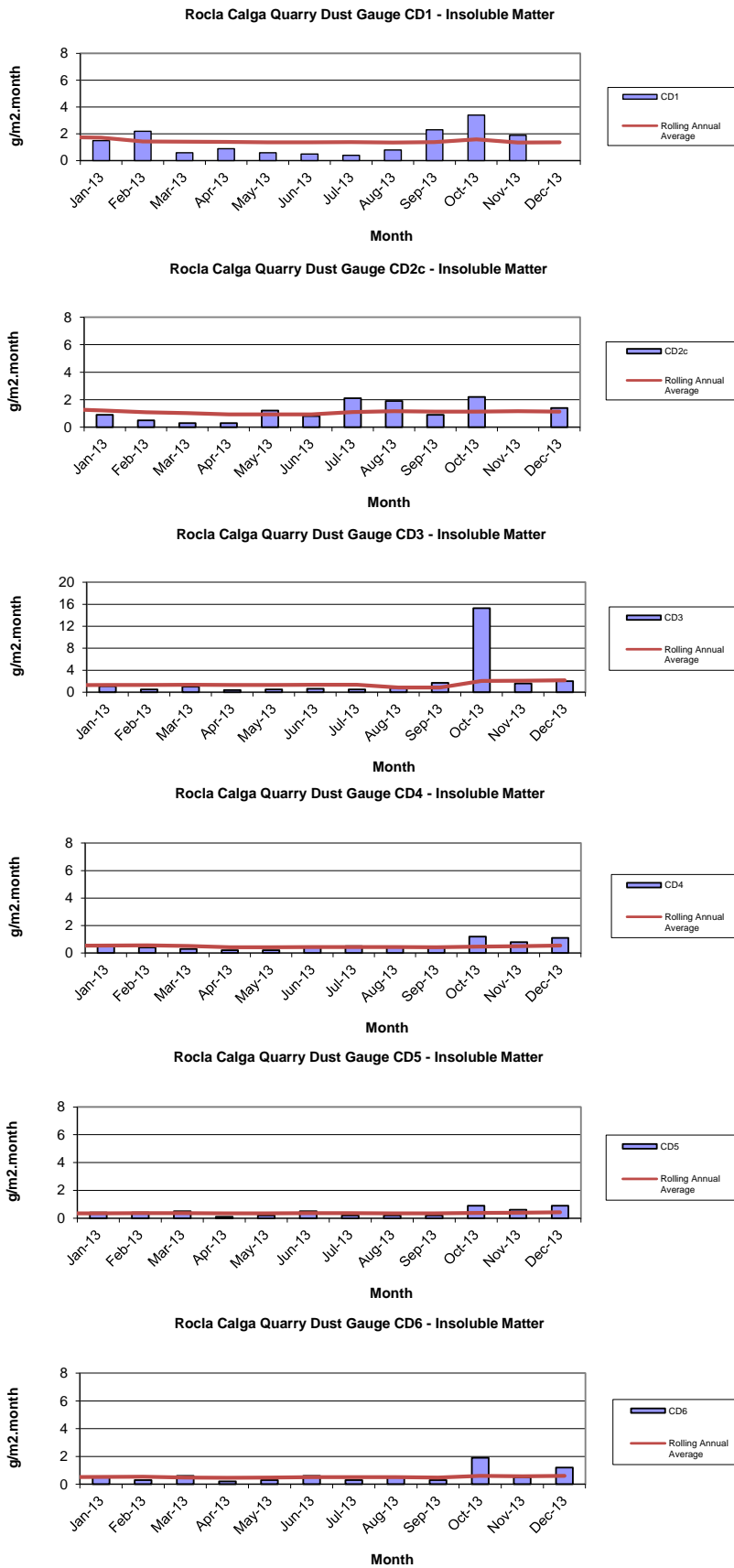
Insoluble Solids marked with an * indicate an excessively contaminated gauge. Contamination can include bird droppings, vegetation (such as plant matter, algae, pollen and seeds) and insects. Results in bold indicate insoluble solids levels above 3.7 g/m².month; the Development Consent’s annual average amenity criteria at residential locations. The current rolling annual average is calculated from January 2013 to December 2013.

NA= Not Available.

CD1 was installed on the 1 May 2006. CD2a was discontinued at the start of August 2006 due to quarry operations “mining out” the site of the gauge. The replacement gauge, Site CD2b, was located in a position adjacent to the boundary between B. Kashouli and F. & J. Gazzana in conformance with the Air Quality Management Plan. CD4 was installed on 3 October 2006, to gauge air quality impacts to the south of the site operations, as were CD5 and CD6 which were installed on the 14 December 2006. CD2b was discontinued at the end of January 2010 due to contamination of the gauge by non-quarry related vehicle movements on a track adjacent to the gauge. The replacement gauge, CD2c, was located on a rehabilitated section of land between the extraction area and adjacent resident.

Dust deposition charts for all dust gauge sites appear in **Figure 2** below. The laboratory analysis is provided in **Appendix 1**.

Figure 2: Dust Deposition Charts



2.2 Surface Water Monitoring

Monthly surface water monitoring was conducted on the 3 January 2014 and results are listed in **Table 2**. The laboratory analysis sheets are provided in **Appendix 1**.

Table 2: Monthly surface water monitoring – December grab sample results

Site	Observed Flow Rate	Water Colour	Turbidity	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)	Oil and Grease (mg/L)
A	Dam	Clear	Clear	5.49	76	57	<5	<5
B	No Flow							
C	No access							
D	Dry							
F	Dam	Clear	Clear	4.97	78	56	<5	<5

Samples were collected at sites A and F. Site C was inaccessible and unable to be sampled this month. There was no flow at Site B and Site D was dry at the time of sampling this month. The samples were collected and analysed for a monthly sampling event. Results show pH within the acidic range, low Electrical Conductivity, low Total Dissolved Solids and low Total Suspended Solids. Oil and Grease was not detected at any site.

2.3 Groundwater Monitoring

Groundwaters were sampled on 3 January 2014. Water quality tests for pH and electrical conductivity were conducted by Carbon Based Environmental Pty Limited. For water quality purposes, water was purged from the bore until constant pH (+/- 0.1 pH units) and Electrical Conductivity (+/- 5%) was obtained between samples. Data is displayed in **Table 3** and **Figures 3 to 6**.

Groundwater depth increased at a majority of sites compared to last month, indicating water generally moving away from the surface. The exceptions being CP3 and MW8 which all showed a slight decrease in depth.

pH at all sites is in the acidic to neutral range. pH levels remained steady across all sampled sites. EC levels were generally similar when compared to the results obtained in November 2013.

Table 3: Groundwater Quality Data

Reference	Bore	Type	Depth to water TOC (m) April 06	Depth to water TOC (m) This report	pH This report	Electrical Conductivity (µS/cm) This report
CQ1	Voutos	* Monitor	20.59	Removed		
CQ3	Voutos	* Monitor	10.53	10.43	6.3	151
CQ4	Voutos	* Monitor	8.78	10.61	4.7	103
CQ5	Gazzana	DIP Only	8.69	7.11	4.2	171
CQ6	Gazzana	DIP Only	16.00	NM	NM	NM
CQ7	Gazzana	* Monitor	6.89	6.59	4.8	100
CQ8	Gazzana	* Monitor	11.03	6.09	4.4	140
CQ9	Gazzana	DIP Only	10.10	9.14	4.4	112
CQ10	Voutos	* Monitor	NI	23.15	6.4	205
CQ11S	Gazzana	* Monitor	NI	10.83	4.5	154
CQ11D	Gazzana	* Monitor	NI	12.01	4.5	159
CQ12	Gazzana	* Monitor	NI	4.52	4.3	129
CQ13	Kashouli	* Monitor	NI	13.98	4.4	225
CP3	Gazzana	Domestic	10.40	9.37	4.7	145
CP4	Kashouli	Domestic	13.63	10.89	NM	NM
CP5	Kashouli	Domestic	16.61	8.35	4.6	227
CP6	Kashouli	Domestic	16.27	11.05	4.5	195
CP7	Kashouli	Production	8.56	3.12	5.2	151
CP8	Rozmanec	Domestic	22.17	NR	NR	NR
MW7	Rocla Bore	* Monitor	15.76	16.03	4.5	114
MW8	Rocla Bore	* Monitor	9.82	7.61	4.7	84
MW9	Rocla Bore	* Monitor	22.44	22.20	4.7	99
MW10	Rocla Bore	* Monitor	15.41	NM	NM	NM
MW13	Rocla Bore	DIP Only	NI	8.07	4.4	100
MW16	Rocla Bore	DIP Only	NI	NM	NM	NM

Notes:

TOC = Water level measured from top of bore case to water.

NM = Not Monitored – unable to sample water due to access restrictions.

NR = Not Required by resident.

* = Logger Installed.

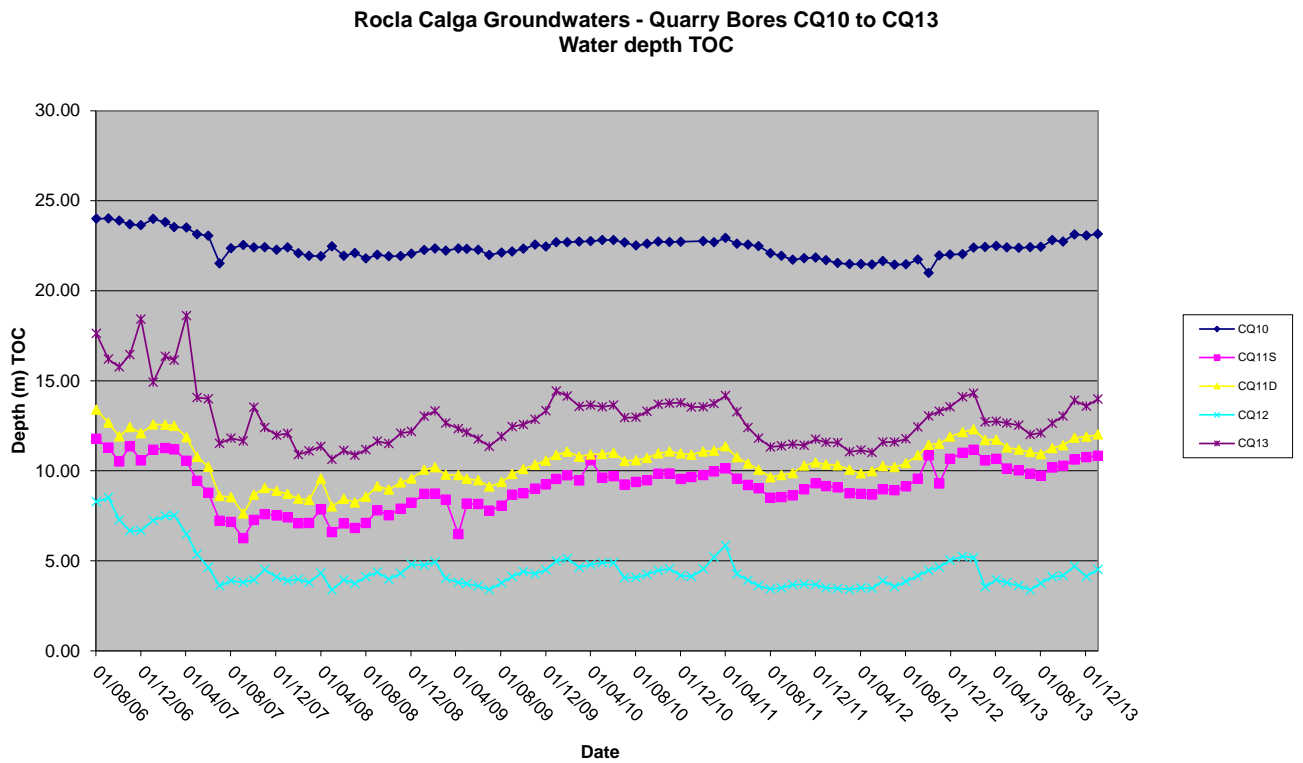
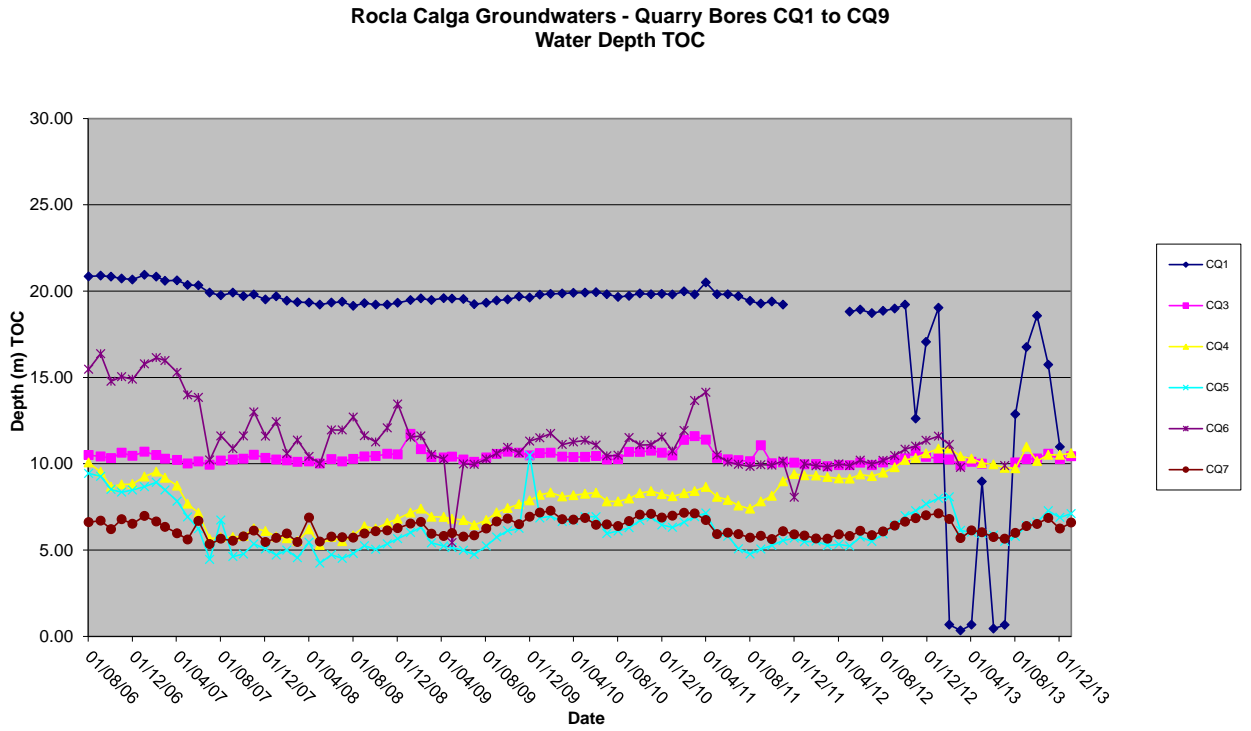
NI = These bores were not installed in April 2006 but are now operational. April 2006 was the first set of measurements taken by Carbon Based Environmental Pty Limited.

Shading is used to indicate the following trends in water depth (compared to the last reading):

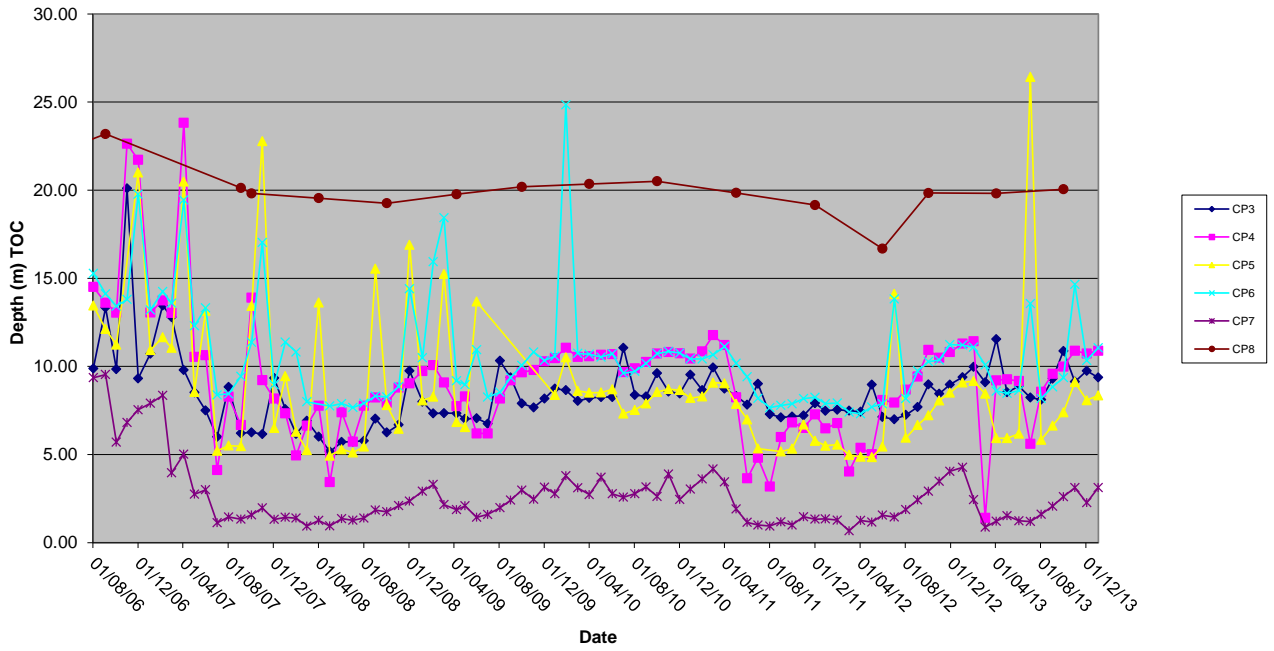
	Increase to ground water depth (water moved away from surface)
	Decrease to ground water depth (water moved towards surface)
	Stable water depth (+/- 0.01m)

Available groundwater loggers were downloaded and will be forwarded to the Rocla Calga Quarry groundwater consultant.

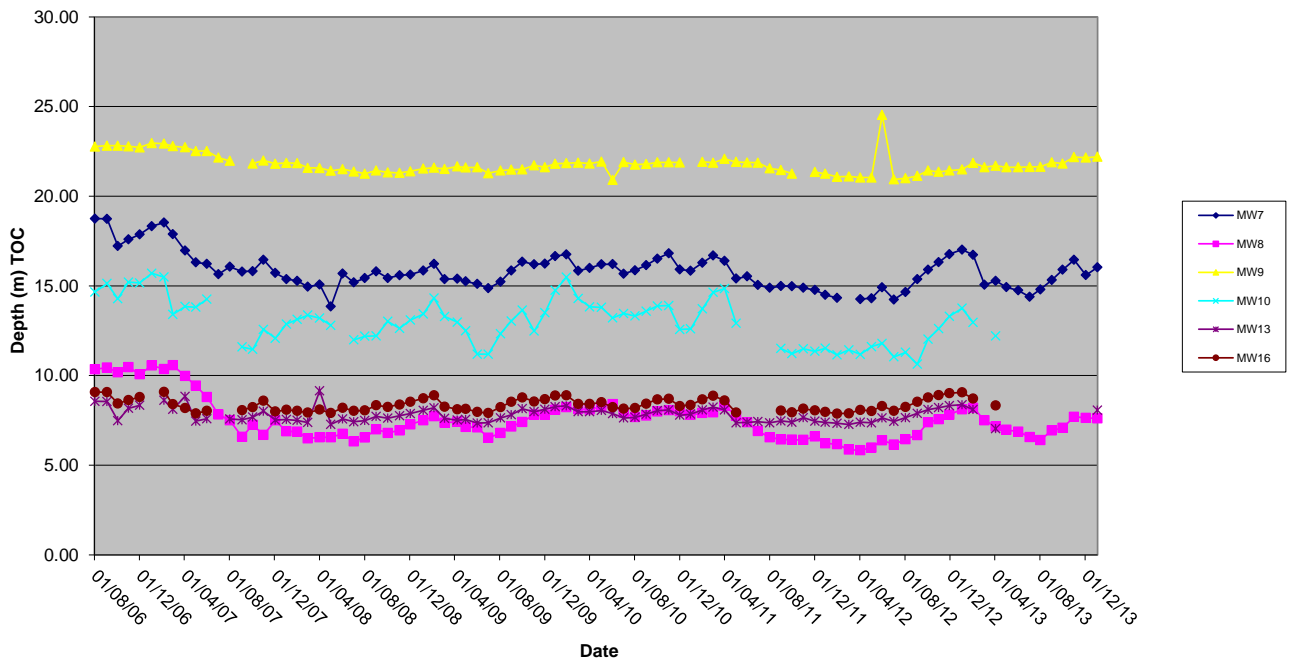
Figures 3 to 6: Groundwater Depth Charts.



Rocla Calga Groundwaters - Quarry Bores CP3 to CP8
Water Depth TOC



Rocla Calga Groundwaters - Quarry Bores MW7 to MW16
Water Depth TOC



2.4 Meteorological Monitoring

The Rocla Calga Quarry weather station data recovery in December 2013 was approximately 100%. The weather station data follows and includes;

- Monthly data numerical summary;
- Weather charts of air temperature, humidity, heat index and wind chill, atmospheric pressure, solar radiation, evapotranspiration, rain, wind speed and data reception; and
- Wind rose (frequency distribution diagram of wind speed and direction).

Monthly weather statistics from the nearby Bureau of Meteorology (BOM) at Peats Ridge station was unavailable for December 2013.

Data for December 2013 shows that rainfall recorded at the Rocla Calga Quarry was lower than the Gosford BOM and the Peats Ridge long term mean rainfall for December 2013. The rainfall comparison is provided below:

Rocla Calga Quarry	14.4 mm
BOM Peats Ridge*	NA
BOM Gosford*	17.8 mm
BOM Peats Ridge Long term mean for December*	95.2 mm

NA = Not Available

*Data sourced from Bureau of Meteorology (BOM) website (www.bom.gov.au).

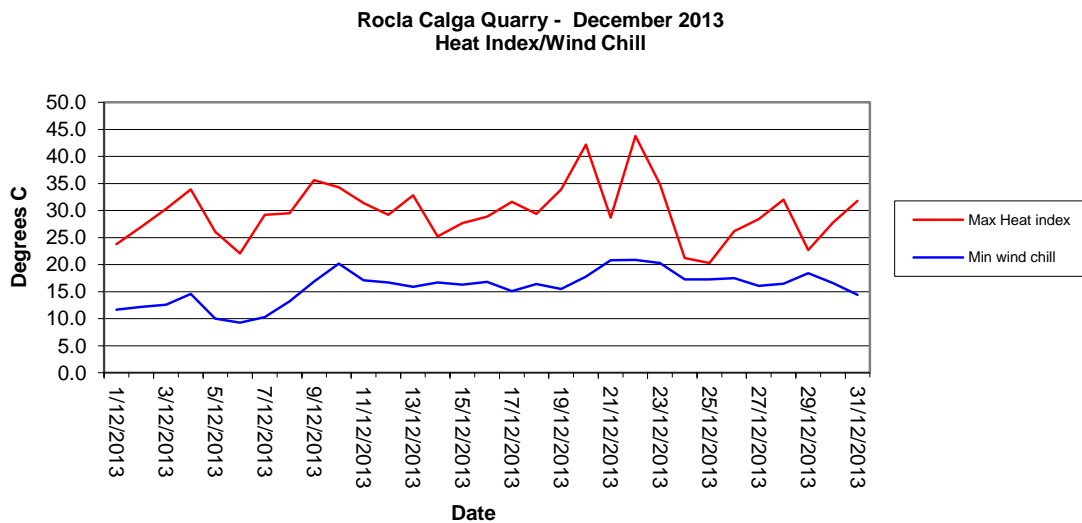
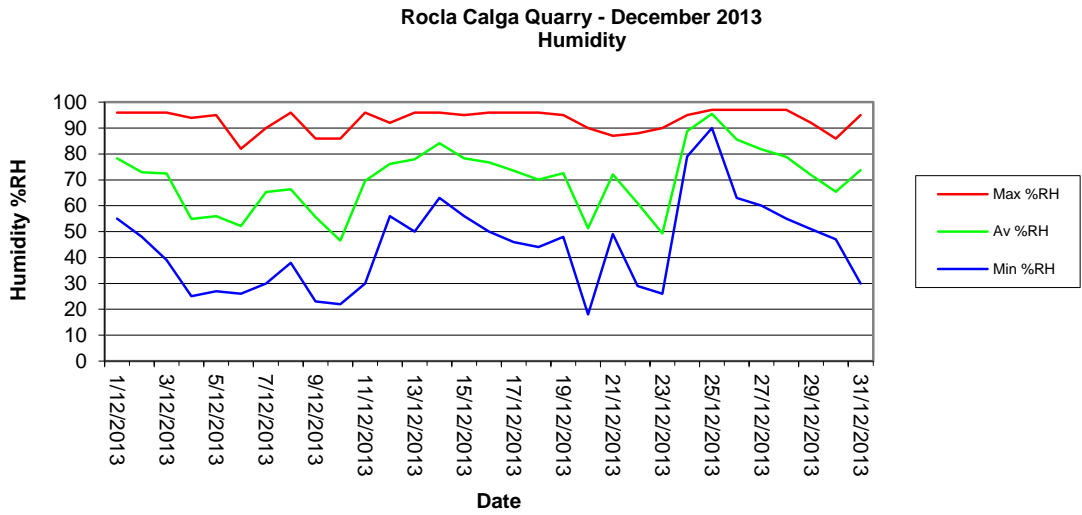
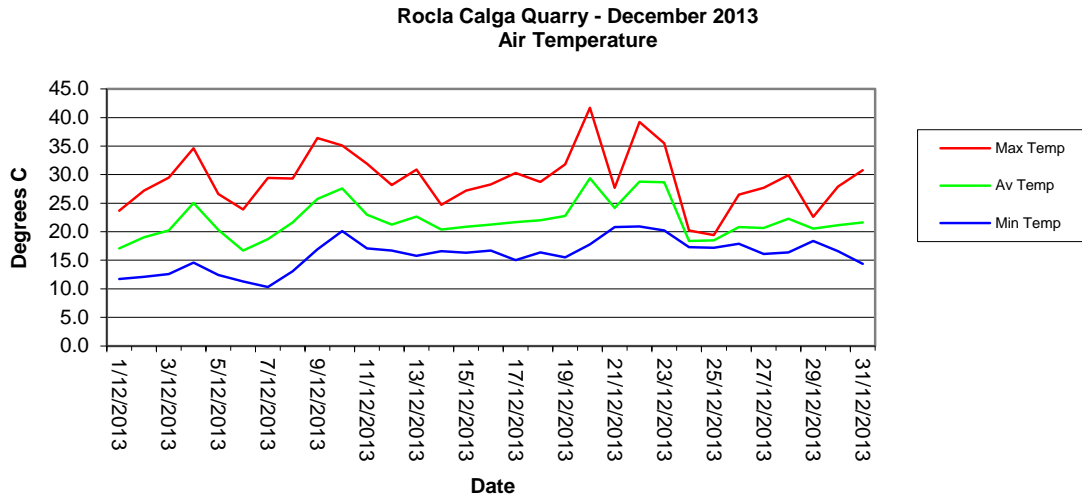
Results are displayed in the following table and figures.

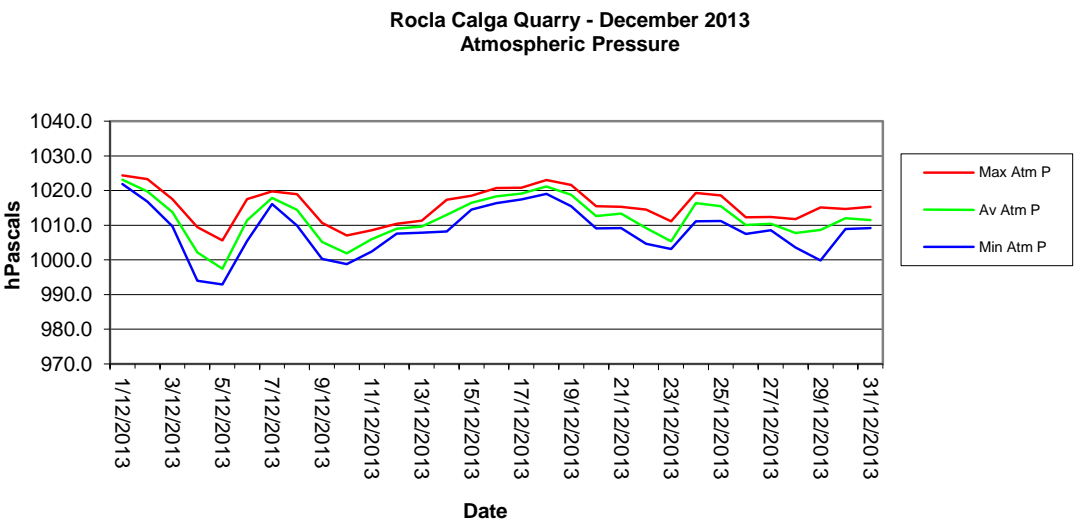
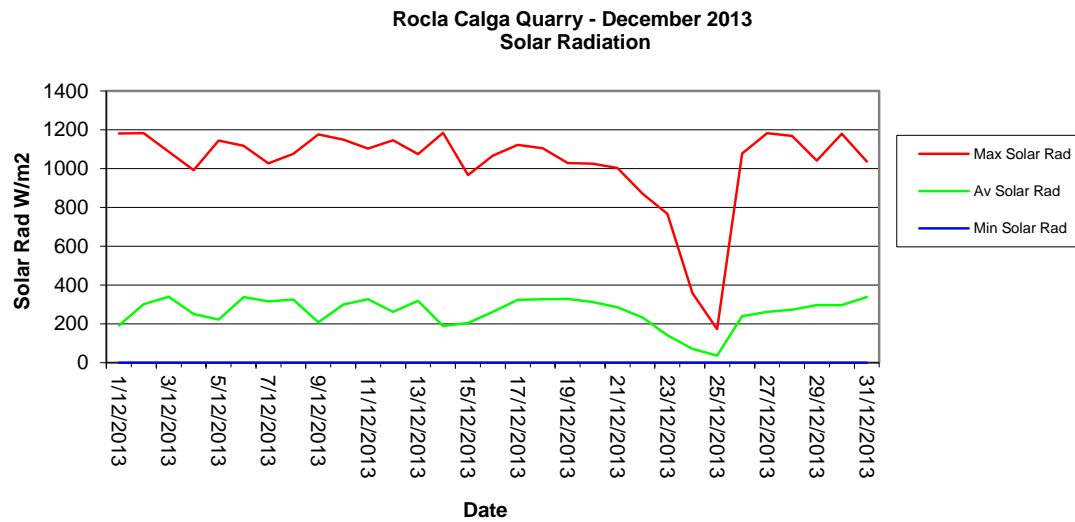
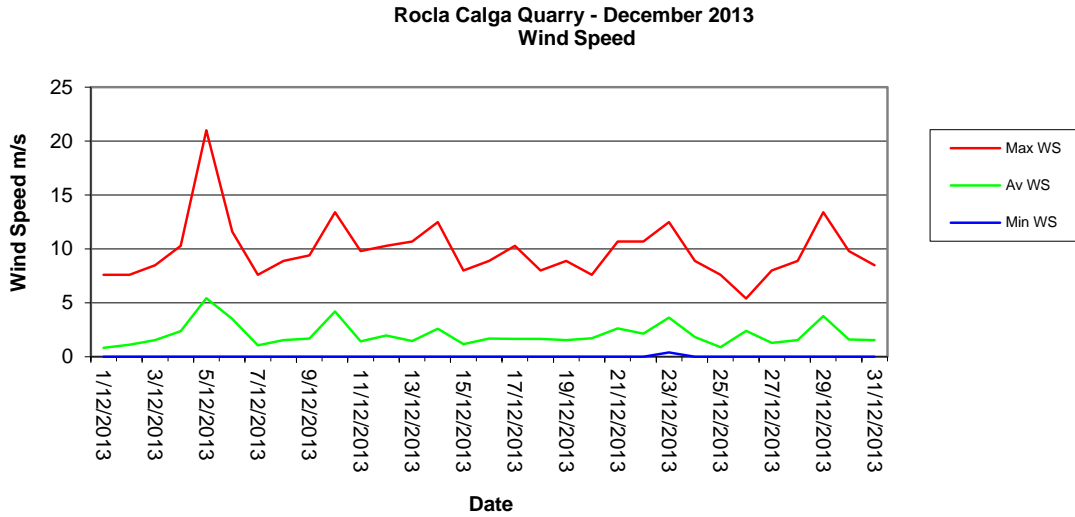
2.4.1 Monthly Meteorological Data Summary

Summary Dec-13 Rocla - Calga

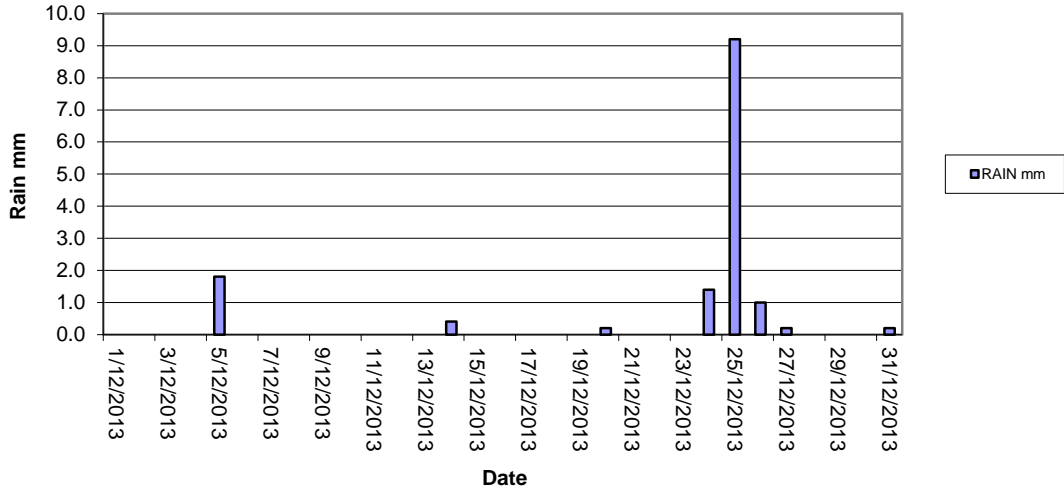
Date	Min Temp	Av Temp	Max Temp	Min %RH	Av %RH	Max %RH	RAIN mm	ET mm	Min WS	Av WS	Max WS	Min wind chill	Max Heat index	Min Atm P	Av Atm P	Max Atm P	Min Solar Rad	Av Solar Rad	Max Solar Rad	Min Data %	Av data %	Max Data %
1/12/2013	11.7	17.1	23.7	55	78	96	0.0	3.2	0	0.8	7.6	11.7	23.8	1021.9	1023.2	1024.4	0	192.0	1181	99.7	100.0	100
2/12/2013	12.1	19.0	27.2	48	73	96	0.0	5.1	0	1.1	7.6	12.2	27.0	1016.8	1019.7	1023.3	0	300.8	1183	82.7	98.7	100
3/12/2013	12.6	20.2	29.5	39	72	96	0.0	6.0	0	1.6	8.5	12.6	30.3	1009.7	1013.8	1017.5	0	338.9	1087	85.4	99.7	100
4/12/2013	14.6	25.1	34.6	25	55	94	0.0	6.2	0	2.4	10.3	14.6	33.9	994.0	1002.1	1009.4	0	250.5	992	86.3	99.6	100
5/12/2013	12.4	20.3	26.6	27	56	95	1.8	12.7	0	5.4	21	10.0	26.1	992.9	997.4	1005.6	0	222.3	1144	77.2	97.3	100
6/12/2013	11.3	16.7	23.9	26	52	82	0.0	6.7	0	3.5	11.6	9.3	22.1	1005.4	1011.4	1017.5	0	337.3	1117	89.8	99.2	100
7/12/2013	10.3	18.7	29.4	30	65	90	0.0	5.5	0	1.1	7.6	10.3	29.2	1016.1	1017.9	1019.7	0	315.5	1027	92.1	99.8	100
8/12/2013	13.1	21.6	29.3	38	66	96	0.0	6.2	0	1.6	8.9	13.2	29.5	1009.9	1014.4	1018.9	0	325.3	1077	99.7	100.0	100
9/12/2013	16.9	25.7	36.4	23	56	86	0.0	5.2	0	1.7	9.4	16.9	35.6	1000.3	1005.2	1010.7	0	207.4	1177	96.8	99.9	100
10/12/2013	20.1	27.6	35.1	22	47	86	0.0	8.7	0	4.2	13.4	20.2	34.3	998.8	1001.8	1007.0	0	300.0	1149	93.9	99.5	100
11/12/2013	17.1	23.0	31.9	30	70	96	0.0	6.0	0	1.4	9.8	17.1	31.4	1002.4	1006.0	1008.5	0	327.2	1103	81.9	99.2	100
12/12/2013	16.7	21.2	28.2	56	76	92	0.0	4.8	0	2.0	10.3	16.7	29.2	1007.6	1009.0	1010.4	0	260.9	1147	95	99.9	100
13/12/2013	15.8	22.6	30.9	50	78	96	0.0	5.6	0	1.5	10.7	15.9	32.8	1007.8	1009.6	1011.3	0	318.3	1074	83	99.0	100
14/12/2013	16.6	20.4	24.7	63	84	96	0.4	3.5	0	2.6	12.5	16.7	25.2	1008.2	1013.0	1017.3	0	188.5	1184	91.8	99.6	100
15/12/2013	16.3	20.8	27.2	56	78	95	0.0	3.8	0	1.2	8	16.3	27.7	1014.5	1016.5	1018.5	0	203.8	966	100	100.0	100
16/12/2013	16.7	21.2	28.3	50	77	96	0.0	4.8	0	1.7	8.9	16.8	28.9	1016.4	1018.3	1020.7	0	260.9	1067	93	99.7	100
17/12/2013	15.0	21.7	30.3	46	73	96	0.0	5.8	0	1.7	10.3	15.1	31.6	1017.4	1019.1	1020.8	0	323.6	1122	90.6	99.7	100
18/12/2013	16.4	22.0	28.7	44	70	96	0.0	6.0	0	1.7	8	16.4	29.4	1019.0	1021.2	1023.0	0	326.6	1105	97.7	99.9	100
19/12/2013	15.5	22.8	31.8	48	73	95	0.0	6.1	0	1.6	8.9	15.5	33.9	1015.5	1018.7	1021.6	0	327.9	1028	86	99.4	100
20/12/2013	17.8	29.4	41.7	18	51	90	0.2	7.2	0	1.7	7.6	17.8	42.2	1009.1	1012.7	1015.5	0	312.3	1026	95.6	99.7	100
21/12/2013	20.8	24.2	27.7	49	72	87	0.0	5.5	0	2.6	10.7	20.8	28.7	1009.2	1013.3	1015.3	0	284.5	1003	93.3	99.5	100
22/12/2013	20.9	28.8	39.2	29	61	88	0.0	5.7	0	2.2	10.7	20.9	43.8	1004.6	1009.1	1014.5	0	232.3	871	99.7	100.0	100
23/12/2013	20.2	28.7	35.5	26	49	90	0.0	5.6	0.4	3.6	12.5	20.3	34.9	1003.1	1005.3	1011.1	0	140.4	767	99.1	100.0	100
24/12/2013	17.3	18.4	20.2	79	89	95	1.4	1.2	0	1.8	8.9	17.3	21.2	1011.1	1016.4	1019.3	0	70.8	359	86	98.9	100
25/12/2013	17.2	18.5	19.4	90	96	97	9.2	0.6	0	0.9	7.6	17.3	20.3	1011.2	1015.5	1018.6	0	36.1	173	77.2	97.1	100
26/12/2013	17.9	20.8	26.5	63	86	97	1.0	4.0	0	2.4	5.4	17.5	26.2	1007.5	1010.1	1012.3	0	238.4	1078	40.9	86.4	100
27/12/2013	16.1	20.7	27.7	60	82	97	0.2	4.4	0	1.3	8	16.1	28.4	1008.5	1010.4	1012.4	0	260.8	1182	68.4	96.2	100
28/12/2013	16.4	22.3	29.9	55	79	97	0.0	5.1	0	1.5	8.9	16.5	32.0	1003.6	1007.7	1011.7	0	272.3	1168	78.9	98.9	100
29/12/2013	18.4	20.5	22.6	51	72	92	0.0	5.8	0	3.8	13.4	18.4	22.7	999.8	1008.6	1015.1	0	296.1	1042	100	100.0	100
30/12/2013	16.6	21.1	27.9	47	65	86	0.0	5.6	0	1.6	9.8	16.6	27.8	1008.9	1012.0	1014.7	0	296.9	1180	82.5	98.4	100
31/12/2013	14.4	21.6	30.8	30	74	95	0.2	5.9	0	1.5	8.5	14.4	31.8	1009.2	1011.5	1015.3	0	337.7	1036	88	99.3	100
Monthly	10.3	22.0	41.7	18	70	97	14.4	168.6	0	2.1	21	9.3	43.8	992.9	1012.0	1024.4	0	261.5	1184	40.9	98.9	100

2.4.2 Monthly Weather Charts

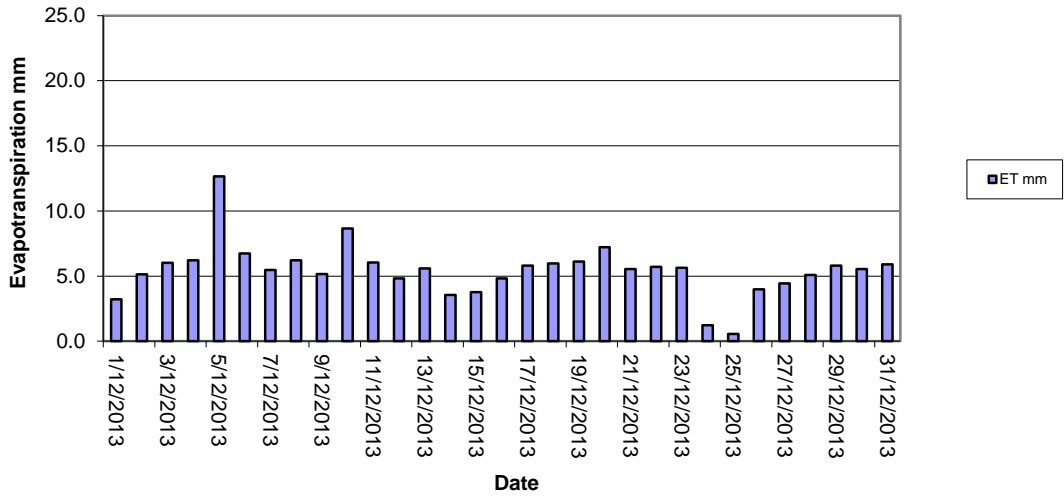




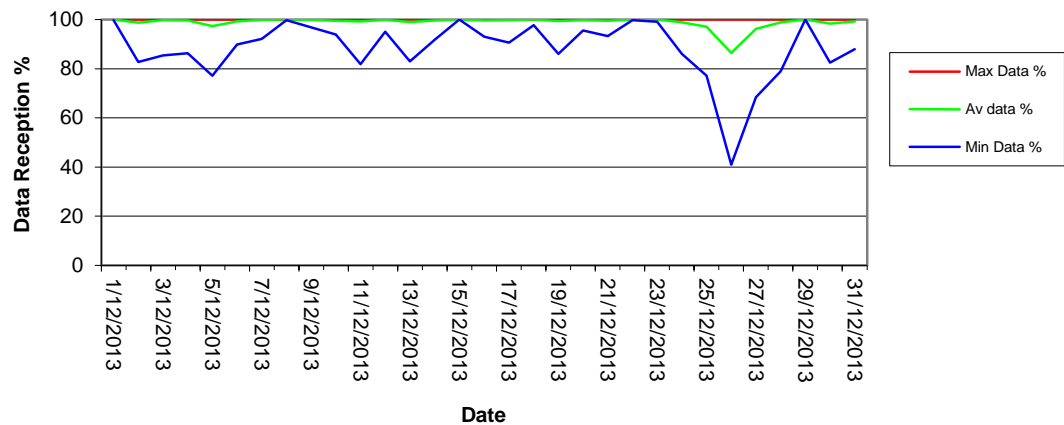
Rocla Calga Quarry - December 2013
Rainfall



Rocla Calga Quarry - December 2013
Evapotranspiration



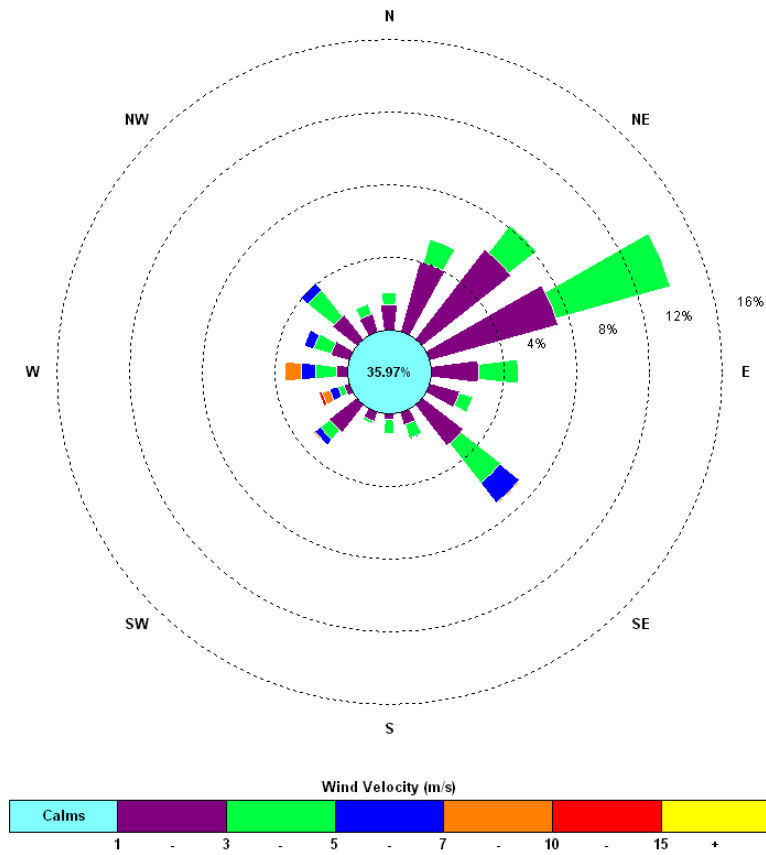
Rocla Calga Quarry - December 2013
Data Reception



2.4.3 Monthly Windrose Plot

Frequency plot of the average wind speed and average direction over each 15 minute sampling period. Wind is considered to be calm when less than a 15 minute average of 1m/s.

00:15, 01 December 2013 – 23:45, 31 December 2013



The predominant winds were from the ENE, with strongest winds from the W and WSW. The maximum wind speed was 21.0 m/s from the W.

Appendix 1
Laboratory Certificates